

CLAIMS

What is claimed is:

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1. A method for producing spray dried particles having targeted aerodynamic properties comprising the steps of:
 - (a) controlling the moisture content of a drying gas to a level selected to form spray dried particles having a targeted aerodynamic diameter or a targeted tap density;
 - (b) atomizing a liquid feed to form liquid droplets; and
 - (c) contacting the liquid droplets with the drying gas, thereby drying the liquid droplets to form spray dried particles having the targeted aerodynamic properties.
 2. The method of Claim 1 wherein the drying gas is selected from the group consisting of air, nitrogen, argon and any combination thereof.
 3. The method of Claim 2 wherein the moisture content is expressed as dew point, frost point or relative humidity.
 4. The method of claim 3 wherein the dew point is in the range between about 0° C and -40° C.
 5. The method of Claim 1 wherein the targeted aerodynamic diameter is less than about 5 microns.
 6. The method of Claim 5 wherein the targeted aerodynamic diameter is less than about 3 microns.

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7. The method of claim 1 wherein the targeted tap density is less than about 0.4 g/cm³.
8. The method of Claim 7 wherein the targeted tap density is less than about 0.1 g/cm³.
- 5 9. The method of Claim 1 wherein the drying gas has an inlet temperature between about 80°C and about 200°C.
10. The method of Claim 1 wherein the drying gas has an outlet temperature between about 35°C and about 80°C.
- 10 11. The method of Claim 1 further comprising separating the spray dried particles from waste drying gas.
12. The method of Claim 1 further comprising collecting the spray dried particles.
13. The method of Claim 1 wherein the liquid feed includes a solvent selected from the group consisting of an organic solvent, an aqueous solvent or any combination thereof.
- 15 14. The method of Claim 1 wherein the spray dried particles comprise a bioactive agent.
15. The method of Claim 1 wherein the spray dried particles comprise a phospholipid.
16. Particles formed by the method of Claim 1.

17. A method for forming particles having a targeted aerodynamic diameter comprising the steps of:
- (a) atomizing a liquid feed to produce liquid droplets; and
 - (b) contacting the liquid droplets with a drying gas having a dew point corresponding to forming particles having the targeted diameter,
- 5 thereby drying the liquid droplets to form the particles.
18. A method for forming particles having a minimized aerodynamic diameter comprising the steps of:
- (a) atomizing a liquid feed to produce liquid droplets; and
 - 10 (b) contacting the liquid droplets with a drying gas having a dew point corresponding to forming particles having the minimized aerodynamic diameter;
- thereby drying the liquid droplets to form the particles having the minimized aerodynamic diameter.
- 15 19. A method for producing spray-dried particles of reduced tap density comprising:
- (a) atomizing a liquid feed to produce liquid droplets; and
 - (b) contacting the liquid droplets with a drying gas having a dew point corresponding to forming particles having the reduced tap density;
- thereby drying the liquid droplets to form the spray dried particles.

20. A method for producing particles comprising:
- (a) atomizing a liquid feed to produce liquid droplets; and
 - (b) contacting the liquid droplets with a drying gas having a dew point between 0° C and -40° C, thereby drying the liquid droplets and producing the particles;
- 5 wherein the particles have an aerodynamic diameter less than about 5 μm and a tap density less than about 0.4 g/cm³.
21. The method of Claim 20 wherein the particles have a tap density less than about 0.1 g/cm³.
- 10 22. A method for producing particles suitable for inhalation comprising
- (a) spraying a liquid feed comprising a biologically active agent; and
 - (b) contacting the sprayed liquid feed with a drying gas having a dew point corresponding to a targeted aerodynamic diameter for the particles, thereby drying the sprayed liquid feed to form the particles.
- 15 23. A method for producing spray-dried particles of reduced tap density comprising:
- (a) atomizing a liquid feed to produce liquid droplets; and
 - (b) contacting the liquid droplets with a drying gas having a dew point corresponding to forming particles having the reduced tap density; thereby drying the liquid droplets to form the spray dried particles.
- 20 24. A method for producing particles comprising:
- (a) atomizing a liquid feed to produce liquid droplets; and
 - (b) contacting the liquid droplets with a drying gas having a dew point between 0° C and -40° C, thereby drying the liquid droplets and producing the particles;
- 25 wherein the particles have a tap density less than 0.4 g/cm³.

25. In a method for spray-drying including atomizing a liquid feed to produce liquid droplets and drying the liquid droplets, the improvement comprising combining a gas with a vapor to form a drying gas having a specified vapor partial pressure and contacting the liquid droplets with the drying gas, thereby drying the liquid droplets.
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26. A method for spray drying particles having a targeted tap density comprising:
- (a) correlating vapor contents of a drying gas with tap densities of particles formed by contacting a sprayed liquid feed with the drying gas;
- (b) selecting a vapor content corresponding to the targeted tap density;
- 10 (c) generating a drying gas having said vapor content; and
- (d) contacting sprayed liquid feed with the drying gas having said vapor content, thereby producing particles having the targeted tap density.
27. A method for producing particles having a targeted aerodynamic diameter comprising:
- 15 (a) correlating vapor contents of a drying gas with aerodynamic diameters of particles formed by contacting a sprayed liquid feed with the drying gas;
- (b) selecting a vapor content corresponding to the targeted aerodynamic diameter;
- (c) generating a drying gas having said vapor content; and
- 20 (d) contacting the sprayed liquid feed with the drying gas having said vapor content thereby producing particles having the targeted aerodynamic diameter.
28. A method for producing spray dried particles having targeted aerodynamic properties comprising the steps of:

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- (a) controlling the solvent vapor content of a drying gas to a level selected to form spray dried particles having a targeted aerodynamic diameter or a targeted tap density;
 - (b) atomizing a liquid feed to form liquid droplets; and
 - (c) contacting the liquid droplets with the drying gas, thereby drying the liquid droplets to form spray dried particles having the targeted aerodynamic properties.